REMARKS

Claims 13-19 and 28-53 are currently pending.

Applicants thank the Examiner for withdrawing the previous 35 U.S.C. § 112 rejection. Applicants also thank the Examiner for the telephone conversation on July 14, 2009 during which the Examiner agreed to consider the Information Disclosure Statement ("IDS") filed March 17, 2009 with the present response. For the Examiner's convenience, a copy of the IDS and Form 1449 is attached at Appendix A. The non-patent references were previously filed on March 17, 2009 and are not being resubmitted herein.

CLAIM REJECTION

Rejection of claims under 35 U.S.C. § 102

The Examiner has maintained the rejection of claims 13, 17, 18, 28, 32, 33, 35-40, 44-48 and 52 under 35 U.S.C. § 102(b) as being anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,451,413 to Fok et al. ("Fok"). See Office Action at p. 2. Claims 17 and 18 depend from independent claim 13. Claims 32-33 depend from independent claim 28. Claim 35 is an independent claim. Claims 37-40 depend from independent claim 36. Claims 45-48 and 52 depend from independent claim 44.

Applicants have discovered a dough improving composition including an oxidoreductase which is at least capable of oxidizing maltose and at least one further dough ingredient or dough additive. Applicants have also discovered a dough improving composition including an oxidoreductase which is at least capable of oxidizing maltose, flour and at least one further dough ingredient or dough additive wherein the oxidoreductase is in an amount which results in the presence in a finished dough of 1 to 10,000 units per kg of flour.

Applicants have further discovered a dough including a dough improving composition including an oxidoreductase which is at least capable of oxidizing maltose and at least one further dough ingredient or dough additive, and flour. Applicants have discovered a flour dough including an oxidoreductase which is at least capable of oxidizing maltose and flour. Applicants have also discovered a baked or dried product produced from a flour dough wherein the flour dough includes an oxidoreductase which is at least capable of oxidizing maltose.

The Examiner maintains the rejection of the claims as being anticipated by Fok and contends that "[t]he oxidoreductase of Fok et al is not limited to glucose oxidase." See Office Action at p .3. Additionally, the Examiner contends that "[t]he ability to oxidize maltose would be inherent and/or obvious to that of Fok et al as the oxidoreductase is used as a dough improver as is claimed." See Office Action at p. 2.

The present invention is the first disclosure that **maltose** in dough can be oxidized by an oxidoreductase in order to *yield beneficial results*. The present invention essentially comprises two components:

1. To **utilize maltose** in the dough to improve the rheological properties of the dough and to improve the quality of the finished product made from the dough; and

2. To use an enzyme that is an oxidoreductase that can **oxidize** the maltose in the dough.

Fok discloses a bread improver composition which includes a yeast derivative. See col. 1, lines 5-6. In one embodiment, the bread improver composition includes a yeast derivative in combination with a reducing agent and/or enzyme preparations having amylase, hemicellulase, oxido-reductase and/or protease activity. See col. 1, line 65 to col. 2, line 5. In a preferred embodiment, the oxidoreductase is glucose oxidase. See col. 2, line 32.

The enzyme class 'oxidoreductase' refers to a **large** group of enzymes. In connection to this, an extract from the Enzyme Nomenclature Book (published by the NC-IUBMB) concerning oxidoreductases and an extract from a database detailing enzymes according to the NC-IUBMB nomenclature is attached at Appendix B and C respectively. As can be seen from the database extract, oxidoreductases are assigned the prefix 'EC 1'. Moreover, as can be seen from the index of the nomenclature book and the database extract, the nomenclature EC 1 refers to a **large number** of ***different*** types of oxidoreductases.

In particular, not all oxidoreductases have the ability to oxidize maltose. In other words it is *not* inherent that an oxidoreductase is capable of oxidizing maltose. For example, Applicants refer the Examiner to pages 55-60 of the nomenclature book which details those enzymes which fall under the group EC 1.1.3- (this includes glucose oxidase and maltose oxidase) and details the substrates which the enzymes act on. As can be seen from these pages, only EC 1.1.3.5 is capable of using maltose as a substrate. Nevertheless, for the avoidance of

doubt, as mentioned in the Declaration filed on 30 May 2008, glucooligosaccharide oxidase is an example of another oxidoreductase which is capable of oxidizing maltose.

Fok does not disclose an oxidoreductase capable of oxidizing maltose such as hexose oxidase or glucooligosaccharide oxidase. The preferred oxidoreductase disclosed in Fok is **glucose oxidase**. See col. 2, line 32. Furthermore, the examples in Fok only refer to the use of the oxidoreductase glucose oxidase. See for example, Example V.

Glucose oxidase is **not** able to oxidize *maltose*. No other oxidoreductase is mentioned in Fok. In connection to this, the present application makes it clear that glucose oxidase is not an enzyme which is capable of oxidizing maltose. See page 6, lines 1-3, of the specification and also see page 56 of the nomenclature book. Glucose oxidase (GOX) has the EC number 1.1.3.4 and it acts on the substrate glucose – it does *not* act on other substrates. In addition, Applicants refer to Garcia *et al*, *J Agric Food Chem*, Vol. 52, p. 3946-3953 (2004) – copy enclosed at Appendix D – which was filed as exhibit B in the last response. This reference is an academic reference which was published after the filing date of the present invention. The second paragraph on page 3946 of the Garcia reference states that GOX catalyses the oxidation of glucose to gluconolactone. In addition, Applicants refer to an extract from "chemistry comes alive" by the American Chemical Society attached at Appendix E. As can be seen from the narrative and the pictures of the time-lapsed beakers, maltose is not a substrate for glucose oxidase.

Therefore, Fok does not describe a dough improving composition or a flour dough including **an oxidoreductase which is at least capable of oxidizing maltose** as described in independent claims 13, 28, 35, 36 and 44. As such, claims 13, 17, 18, 28, 32, 33, 35-40, 44-48 and 52 are not anticipated by Fok. Applicants respectfully request reconsideration and the withdrawal of this rejection.

Rejection of claims under 35 U.S.C. § 103

The Examiner has maintained the rejection of claims 13, 17, 18, 28, 32, 33, 35-40, 44-48 and 52 in the alternative, under 35 U.S.C. § 103(a) as being obvious over Fok. See Office Action at p. 2. The Examiner has further maintained the rejection of claims 14-16, 19, 29-31, 34, 41-43, 49-51 and 53 under 35 U.S.C. § 103(a) as being unpatentable over Fok. See Office

Action at p. 3. Claims 14-19 depend from independent claim 13. Claims 29-34 depend from independent claim 28. Claim 35 is an independent claim. Claims 37-43 depend from independent claim 36. Claims 45-53 depend from independent claim 44.

As previously explained, Fok does not describe a dough improving composition or a flour dough including **an oxidoreductase which is at least capable of oxidizing maltose** as described in independent claims 13, 28, 35, 36 and 44. Fok further does not teach or suggest a dough improving composition or a flour dough including **an oxidoreductase which is at least capable of oxidizing maltose** as described in independent claims 13, 28, 35, 36 and 44.

Until the present invention, **no one** had considered maltose as being a suitable or beneficial enzymatic target for oxidation in dough processing. In fact the art around the time of filing actually teaches the skilled person to *increase* the amount of maltose in a dough and not to *reduce* the amount of maltose in the dough as per the present invention. In other words, there was a **technical prejudice** in the art not to reduce the amount of maltose. To put it another way, there were **clear disincentives** in the art to use oxidoreductases which reduce the amount of maltose. Hence, until the present invention, there was no motivation for the skilled person to utilize an oxidoreductase capable of oxidizing maltose. In fact, there were clear teachings in the art not to do so.

For example, page 100 of the textbook Industrial Enzymology (copy attached at Appendix F) discloses that the enzyme glucose oxidase should be used in baking. This textbook was published after the priority date of the present application and provides a good picture of the state of mind of the skilled person at the priority date of the present invention. Additionally, U.S. Patent No. 2,783,150 (copy attached at Appendix G) teaches that the addition of glucose oxidase has a very marked maturing effect on baking compositions (see column 1, lines 40-44, and the sentence spanning columns 2 and 3). U.S. Patent No. 2,783,150 was published in 1957 – which is over 37 years *before* the priority date of the present invention. Further, EP 0321811 (copy attached at Appendix H) cross-references early prior art references (e.g. U.S. Patent No. 2,783,150) which relate to the use of glucose oxidase in baking (see page 2, line 32). For instance, page 7, lines 5-6, and page 8, lines 57-58 of EP 0321811, disclose that "a glucose oxidase/SXH [sulphydryl oxidase] combination is the **most efficient and economical preparation** for dough conditioning." (emphasis added). Thus, the prior art teaches the skilled

person to **use glucose oxidase** in the production of dough. The prior art also teaches that the *levels* of **maltose** in dough should be **increased**.

For example, EP 0468731 (copy enclosed at Appendix I) discloses that it is important to use amylases with glucose oxidase as the amylase hydrolyzes starches to **maltose** and this enzymatic product provides extensibility to the dough, improves oven spring and keeps the quality of the dough (page 1, lines 41-44, and page 3, lines 5-8 of EP 0468731). Thus, this document teaches the skilled person to *increase* maltose levels and not to degrade maltose. Further, EP 0338452 (copy enclosed at Appendix J) mentions that an *increased* formation of **maltose** improves the crust color, aroma and taste of the final product (page 2, lines 39-41 of EP 0338452). Again, this document teaches the skilled person to *increase* maltose levels and not to degrade maltose.

Hence, the skilled person would have readily considered that it was *important* not to reduce the level of maltose in the dough. In other words, there was a technical prejudice in the art. In contrast, the present inventors *surprisingly* found that, by utilizing an oxidoreductase which *oxidizes maltose* in the dough and, thus, *reduces* the levels of maltose in the dough, the dough improving composition of the present invention results in desirable improvements in doughs. Namely, the composition improves the quality of dough and the finished products of dough – in particular it improves the rheological properties, extensibility, stability, volume and strength (see page 5, lines 16-29; page 7, lines 17-21; page 12, line 32, to page 15, line 2; paragraphs spanning pages 15 and 16; Example 2.4; Example 3; Example 4; and Example 5 of the specification). When an oxidoreductase oxidizes maltose in a dough, H_2O_2 is released which oxidises free thiol groups on gluten molecules in the dough. This results in the formation of disulphide bridges in the gluten network, resulting in a dough with better rheological properties.

To summarize the arguments presented above:

1) the term "oxidoreductase" refers to a **large number** of enzymes;
2) the **majority** of oxidoreductases cannot oxidize maltose;
3) the prior art clearly teaches the skilled person to *use* the oxidoreductase **glucose oxidase** – which cannot oxidize maltose - in baking compositions;
4) there was a **technical prejudice** in the art *against reducing* the levels of *maltose* in dough; and
5) the inventors **surprisingly** found that *reducing* the levels of maltose in dough by oxidation *improves* the quality of dough and the finished products of dough.

MPEP 2145, paragraph X. A, states that "[a]ny judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill in that art at the time the claimed invention was made and **does not include knowledge gleaned only from applicant's disclosure,** such a reconstruction is proper" (emphasis added by Applicants) (citing In *re McLaughlin* 443 F.2d 1392, 1395 (CCPA 1971)).

Fok does not disclose *any* advantages in using an oxidoreductase capable of oxidizing maltose when preparing a dough. Hence, there is no motivation in Fok for the skilled person to select those oxidoreductases capable of oxidizing maltose over and above the **plethora** of other oxidoreductases known in the art which have *different* activities. In fact, the art actually teaches the skilled person to use a completely different enzyme - namely glucose oxidase. Moreover, Fok actually teaches the skilled person to use the preferred embodiment glucose oxidase (which does not use maltose as a substrate). To assert that the skilled person would have departed from the preferred and exemplified combination taught in Fok is hindsight analysis. Furthermore, the art as described above actually teaches that the **presence** of maltose in dough has the *advantageous* effects of: providing extensibility to the dough; improving oven spring; keeping the quality of the dough; and improving the crust color, aroma and taste of the final product. Thus, the skilled person would have considered that the amount of maltose in the dough should not be reduced. Hence, the skilled person would have actually considered the use of an oxidoreductase which does not act on maltose – such as glucose oxidase (as per the teaching of Fok). To assert that the skilled person would have departed from the prior art teachings is hindsight analysis.

As such, there is no motivation to modify the teachings of Fok to arrive at the present invention. Fok further does not teach or suggest a dough improving composition or a flour dough including **an oxidoreductase which is at least capable of oxidizing maltose** as described in independent claims 13, 28, 35, 36 and 44.

Accordingly, claims 13, 28, 35, 36 and 44, and claims that depend therefrom are patentable over Fok. Applicants respectfully request that this rejection be reconsidered and withdrawn.

CONCLUSION

For the foregoing reasons, Applicants respectfully request reconsideration and withdrawal of the pending rejections. Applicants believe that the claims now pending are in condition for allowance. A petition for a one-month extension of time is attached.

Should any fees be required by the present Amendment, the Commissioner is hereby authorized to charge Deposit Account **19-4293**.

Respectfully submitted,

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APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

APPENDIX F

APPENDIX G

APPENDIX H

APPENDIX I

APPENDIX J